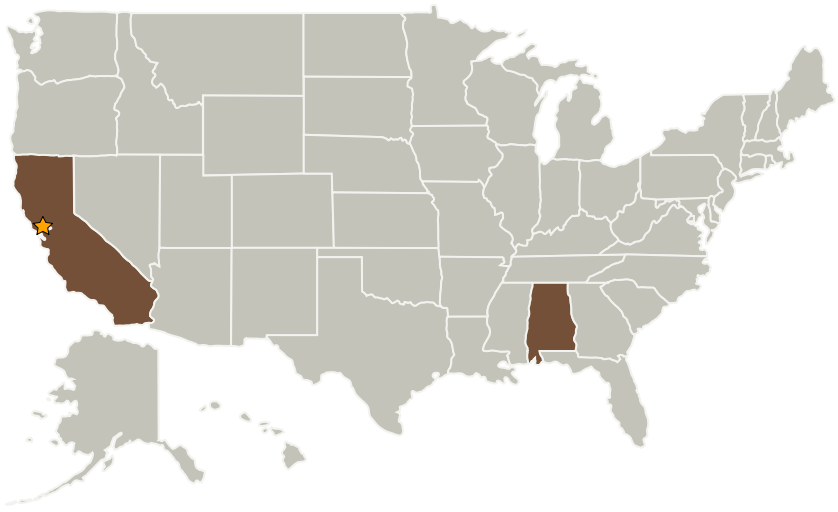
Improved Understanding of Space Radiation Effects on Exploration Electronics by Advanced Modeling of Nanoscale Devices and Novel Materials, Phase I

Completed Technology Project (2005 - 2006)

Project Introduction

Future NASA space exploration missions will use nanometer-scale electronic technologies which call for a shift in how radiation effects in such devices and materials are viewed. The energy deposition by ionizing particles (so called single event effects) can no longer be treated as an average deposition (linear energy transfer, LET). Nano-scale electronic device responses are strongly related to the microstructure of the radiation event. This requires a much more detailed physics-based modeling approach. It is also important to convert such results into engineering models used in device and circuit designs. Hence, the proposed innovation: detailed high-energy-physics-based simulations of radiation events efficiently coupled with advanced device response computations. The innovative Technology Transfer: interface specification and implementation to allow smooth, automated integration between Vanderbilt University high-energy particle advanced computations and CFDRC Device Simulator, and to enable statistically meaningful runs on a massively parallel supercomputing cluster. Significance for NASA: the impact of such radiation events has implications for nano-scale devices operating in space exploration environments. The new approach to understanding the single-event response of semiconductor materials, devices, and circuits is necessary for reliable engineering models used for early design assessment, radiation hardening, and to reduce the amount of radiation testing cost and time.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
★Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
CFD Research Corporation	Supporting Organization	Industry	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	California

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Ames Research Center (ARC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Marek Turowski

Technology Areas

Primary:

- TX02 Flight Computing and Avionics
  - TX02.3 Avionics Tools, Models, and Analysis
    - TX02.3.2 Space Radiation Analysis and Modeling